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A.D. 1853. . . . . N° 922.

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S P E C I F I C A T I O N

OF

SAMUEL BAYLISS.

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CONSUMING OR PREVENTING SMOKE AND  
HEATING LIQUIDS.

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L O N D O N :

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,  
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY :

PUBLISHED AT THE QUEEN'S PRINTING OFFICE, EAST HARDING STREET,  
NEAR FLEET STREET.

*Price 8½d.*

1853.





A.D. 1853 . . . . . N° 922.

**Consuming or Preventing Smoke and Heating Liquids.**

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**LETTERS PATENT** to Samuel Bayliss, of Old Broad Street, in the City of London, in the County of Middlesex, for the Invention of “**IMPROVEMENTS IN CONSUMING OR PREVENTING SMOKE AND HEATING LIQUIDS.**”

Sealed the 29th September 1853, and dated the 16th April 1853.

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**PROVISIONAL SPECIFICATION** left by the said Samuel Bayliss at the Office of the Commissioners of Patents, with his Petition, on the 16th April 1853.

I, SAMUEL BAYLISS, do hereby declare the nature of the said Inven-  
5 tion for “**IMPROVEMENTS IN CONSUMING OR PREVENTING SMOKE AND HEATING LIQUIDS,**” to be as follows :—

In place of the ordinary “fire-bridge,” I employ an air chamber and a series of cylinders or bars, of any convenient form, in metal or clay, which I term “admixers and heat-retainers,” the object being to cause  
10 the smoke and gasses arising from the combustion of the fuel, to be thoroughly incorporated with a sufficient quantity of air and heat to ignite and pass off in flame. *a*, is the air chamber, having apertures in its top *b*, for admitting air amongst the admixers *c*. *e*, is a pipe for



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supplying air to chamber *a*, having a regulating valve attached to it. Spaces *d*, are left between the admixers for the passage of the products of combustion; and the several rows of admixers are so arranged that the cylinders or bars composing one row stand opposite spaces in another. *f*, is a fence placed across the furnace to prevent the fuel 5 getting amongst the admixers; and *g*, is a deflector for throwing the flame downwards, and bringing it in better contact with the streams of air rising from the chamber *a*.

Or I employ admixers and heat-retainers, fixed on the ordinary brick “fire-bridge;” and, in lieu of the air chamber *a*, apertures are provided 10 in the furnace door to admit a supply of air above the fuel.

For heating liquids quicker, and with a less expenditure of fuel, than has been hitherto attainable, I place rows of heat-retainers *c*, from the air chamber *a*, to the end of the boiler, or, in ordinary furnaces, from the “fire-bridge” to the end of the boiler, which, being maintained at 15 a red heat by the passing flame and heated gasses, give out by radiation to the surface of the boiler a large quantity of heat, which would otherwise pass up the chimney and be wasted.

Another improvement is to fix hollow cones, open at both ends, over and just above the bottom surface of boilers and other vessels for 20 heating liquids. They are to stand on legs, or to be otherwise fixed, so as to leave a free passage for the liquids underneath and through them. The object is to produce ascending and descending currents, for the purpose of carrying off the globules of steam from the heating surface as fast as they are formed, which will have the useful effect of accele- 25 rating the evaporation, and protecting the iron from being burnt.

This Invention is represented as applied to a steam engine furnace, but it is applicable to other kinds.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Samuel Bayliss, in the Great Seal Patent Office, 30 on the 15th October 1853.

**TO ALL TO WHOM THESE PRESENTS SHALL COME, I, SAMUEL BAYLISS, of Old Broad Street, in the City of London and County of Middlesex, send greeting.**



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WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Sixteenth day of April, in the year of our Lord One thousand eight hundred and fifty-three, in the sixteenth year of Her reign, did, for Herself, Her heirs and successors,  
5 give and grant unto me, the said Samuel Bayliss, Her special licence that I, the said Samuel Bayliss, my executors, administrators, and assigns, or such others as I, the said Samuel Bayliss, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term  
10 therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN CONSUMING OR PREVENTING SMOKE AND HEATING LIQUIDS," upon the condition (amongst others) that I, the said Samuel Bayliss, by an instru-  
15 ment in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

20 NOW KNOW YE, that I, the said Samuel Bayliss, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :

The objects sought to be attained by this Invention are, first, perfect  
25 combustion of the gases arising from the heated fuel in steam-engine and other furnaces, for the purpose of preventing smoke and economizing coal ; secondly, to retain within such furnaces much of the heat which now passes away to the chimney without producing any useful effect ; and, thirdly, to facilitate evaporation by causing a rapid circu-  
30 lation in the liquids to be heated.

My improvements are illustrated by the accompanying sheet of drawings, which are to a scale of one twelfth the real size ; the same letters of reference indicating the same parts throughout.

Touching the first part of these improvements, the principal gases  
35 we have to deal with in a furnace are carburetted hydrogen, bi-carbu-



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retted hydrogen, and carbonic oxide, the atoms of which must be chemically united with oxygen derived from the air, and be supplied with the requisite temperature, before combustion can take place. The difficulty hitherto has been to accomplish this union; for the gases, sweeping along in a body towards the chimney with great rapidity, at 5 the rate of about thirty feet per second, there is not sufficient time for a thorough mixture of them with the air to take place, at all events, while in contact with the degree of heat necessary for their ignition. I therefore propose to compensate for this want of time by intercepting the gases on their way from the fireplace to the chimney, dividing 10 them into a number of small streams or bodies, and forcing them into mechanical mixture with air, rising in small currents, in order to facilitate the chemical union of them with oxygen, and produce a combustible mixture, and to do this in such place and manner as to ensure the necessary heat for their combustion. The means I adopt 15 to secure this desirable result are shewn in drawings Figures 1, to 12, both inclusive. In place of the ordinary fire-bridge, I employ an air chamber D, formed by two cast iron plates E, F, built in or otherwise fixed to the walls or sides of the furnace. G, is a door, hung on plate E, for regulating the admission of air to the chamber D, and his 20 actuated by the rod H. The upper part of plate E, serves as support for the fire-bars on one side, and the bearing bars *a*, on the other. The upper part of plate F, consists of an iron dead plate, extending across the furnace, intended to prevent the air from chamber D, reaching the flues, without first of all being incorporated with the 25 gases. *a, a, a, a*, are bearing bars, laid lengthwise from side to side of the air chamber, and are kept secure in their places by being simply dropped in slots prepared for them. *b, b, &c.*, are a series of what I term "admixers and heat-retainers," consisting of rows of solid bars of any convenient form, in metal or clay, or any suitable fire-resisting 30 substance, having spaces *d*, between them, of sufficient area in the aggregate for the passage of the products of combustion; and the rows of admixers being placed a distance apart, having spaces *f*, between them for the admission of currents of air from the chamber D, to commingle with the gases. J, is a fence extending across the furnace to prevent 35



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the fuel getting amongst the admixers, and is retained in its proper position by means of projections on the under side, one at each end, which fit into holes in the top of plate E, on which it rests. K, shewn in dotted lines, is a deflector for throwing the flames downwards, and  
5 giving it an extended sweep under the rest of the boiler; but this may be dispensed with, not being essential to the action of the apparatus. It will be seen by the foregoing description that the gases cannot fail to be brought into the most intimate mechanical mixture with the air, in the endeavour to find their way through the numerous channels  
10 presented to them by such an array of bars, and the agitation consequent thereon; and as the bars become red hot, and form besides a great natural harbour for heat, a steady combustion goes on from one end of the admixers to the other. A row of admixers is represented separately at Figure 5, which is a front elevation; Figure 6, a vertical  
15 section; and Figure 7, a plan. Figures 8, 9, and 10, shew respectively a front elevation, vertical section, and plan of another mode of constructing the rows of admixers, the difference being that the base *b*, is made with holes through it, in which the upright bars *c*, are fixed. Figure 11, is a vertical section of a third plan, varying from the latter  
20 only in having projecting shoulders *g*, on the bars *c*, in lieu of reducing the thickness of them at their lower ends. Perforated plates of metal or slabs of fire-clay might be used in substitution of the admixers already described. The admixers may be placed vertically or horizontally, as is thought best. I prefer having the admixers made of cast  
25 iron, when the heat of the furnace is not so intense as to burn them away too rapidly, on account of the cheapness of the metal, and the facility it offers for renewing them. For furnaces of very high temperature, the plan shown in vertical section at Figure 14, may be adopted with advantage. It is composed of two vessels of plate iron L, M,  
30 built in the sides of the furnace, and connected together by metal pipes or tubes *h*, which serve as admixers, &c. A pipe N, communicates with the force pump, and another pipe P, with the boiler; and thus all the water that enters the latter must pass through the tubular admixers, and, by absorbing the heat, prevent them from being burnt



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away. This method has the additional advantage of heating the supply water, which would prove a further source of economy in the expenditure for fuel. . Although I have explained this part of my Invention as applied to a Cornish boiler, set with the fireplace underneath, it will be apparent that it is equally applicable where the fireplace is inside 5 the "internal flue," and also to pans of various descriptions for evaporating liquids.

The second part of my Invention is to extend the "admixers and heat-retainers" to the end of the boiler, and again, if thought desirable, through the "internal tube." These being maintained at a red heat by 10 the passing flame and heated gases, will give off by radiation to the surface of the boiler a great quantity of heat, which would otherwise pass up the chimney and be wasted; they will form, in fact, a continuous fire from one end of the boiler to the other, and tend to spread the heat more uniformly throughout the furnace. For evaporating pans, 15 such as those used in the manufacture of salt, for example, where slow combustion and uniform heat under the whole surface are desirable, I believe this part of my Invention will be found of great practical use.

The third part of this Invention is shown by Figures 13, and 14, the former being in plan, the latter in elevation. R, R, is a portion of 20 the bottom of a boiler or evaporating pan; *m, n, o*, hollow cones, open at top and bottom, as shewn by *n*, which is a section of one of them. They are supported on legs, and fixed just above the surface of the boiler or pan, so as to leave a free passage for the liquid underneath and through them, and should be sufficiently heavy to maintain their 25 positions by their own gravity, or a number of them may be fixed to bars of iron, which bars may be fastened down in any convenient manner, and in this case the legs will be unnecessary. The object is to produce ascending and descending currents in the liquid to be heated, for the purpose of carrying off the globules of steam from the heating 30 surface as fast as they are formed, which will have the useful effect of accelerating its evaporation, and protecting the iron from being burnt. The action is simple and effective. On heat being applied to the bottom of the boiler or pan, it expands the liquids in the cones, and causes

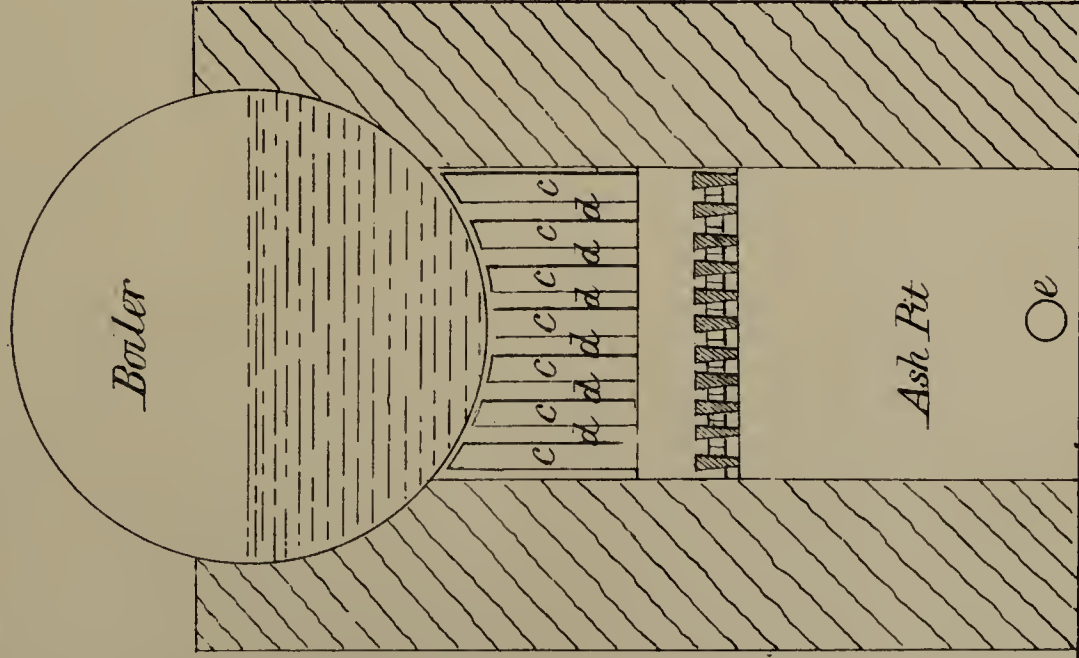


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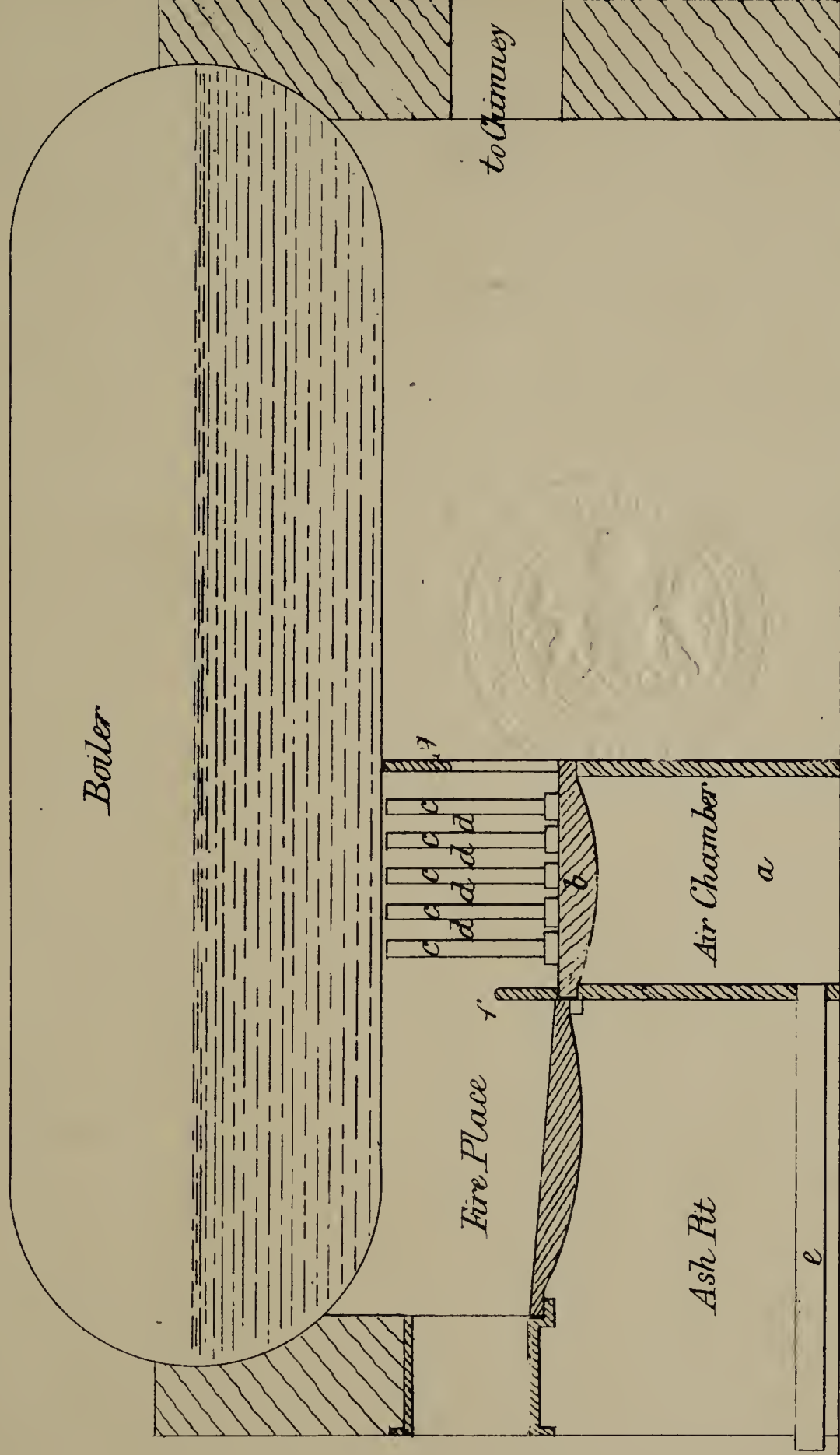
BAYLIS'S PROVISIONAL SPECIFICATION.

(1 SHEET)

*Transverse Section.*



*Longitudinal Section.*



*The Drawing left with Provisional Specification is not Colored.*

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FIG. 1.  
*Transverse Section.*

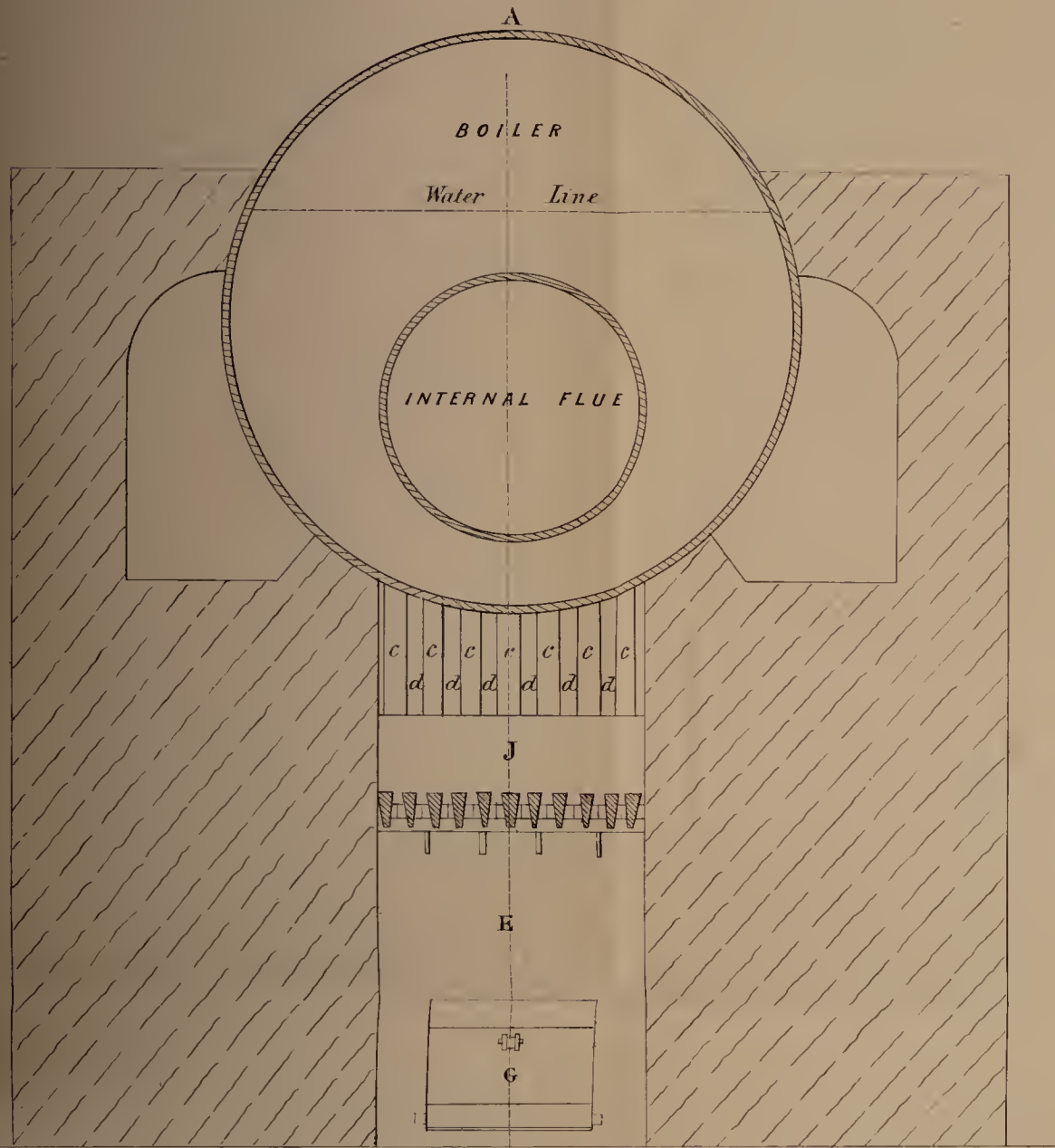


FIG. 2.  
*Longitudinal Section.*

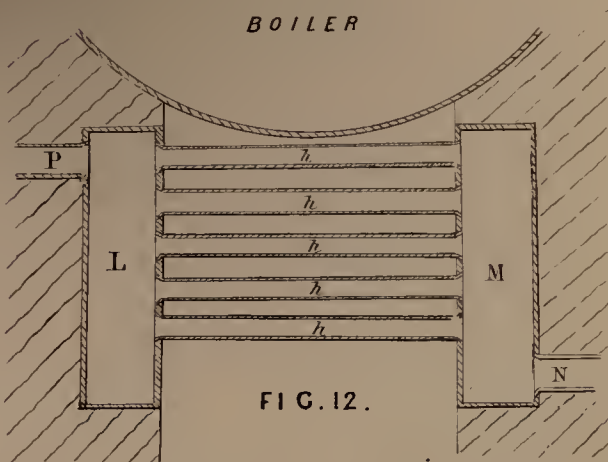
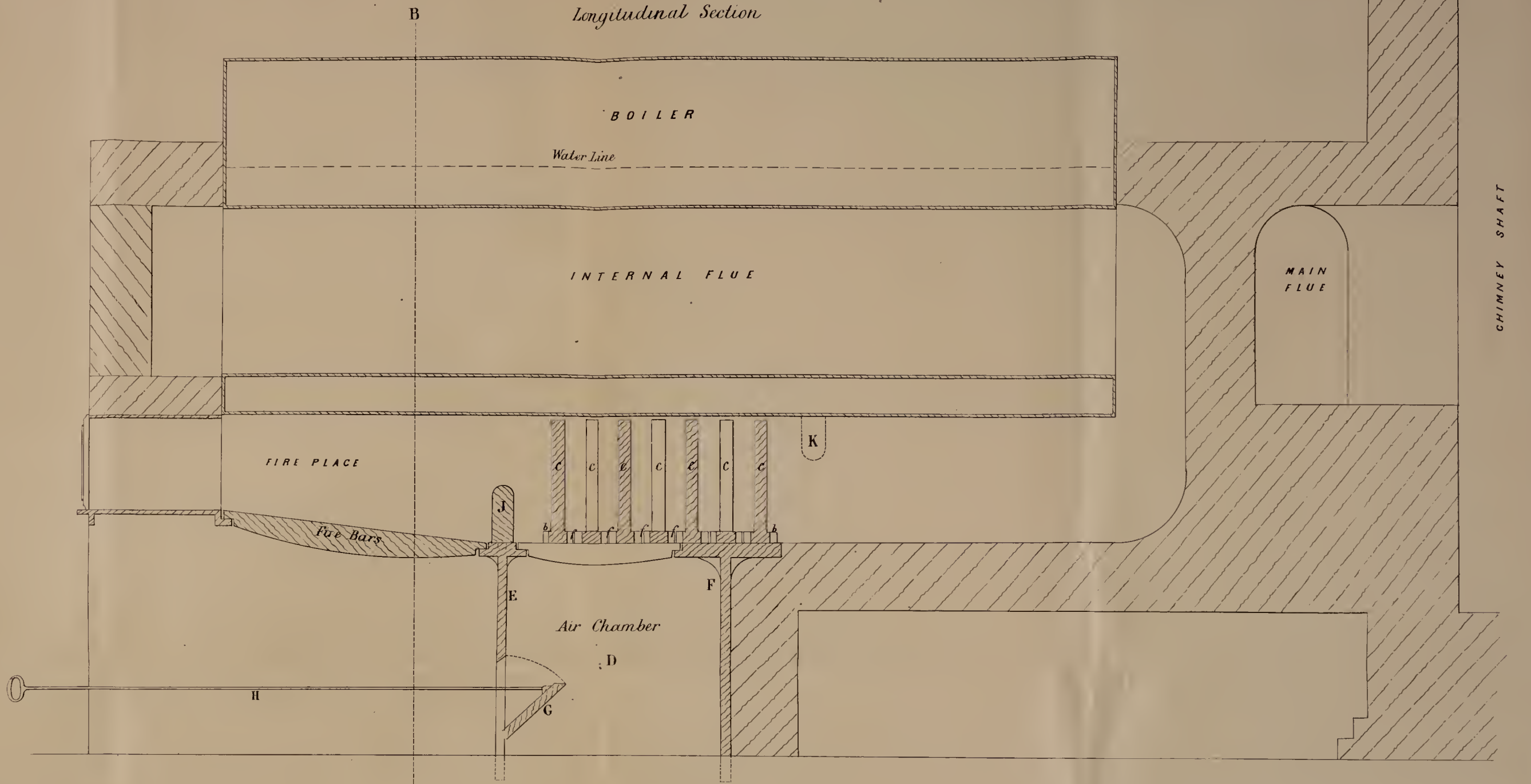


FIG. 10.



FIG. 9.

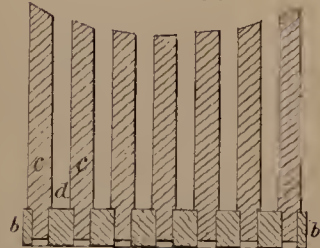


FIG. 8.

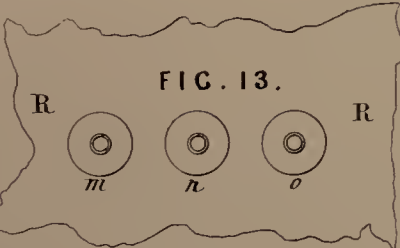
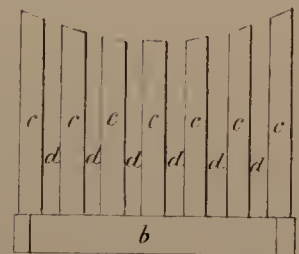


FIG. 14.



FIG. 3.  
*Sectional Plan of Furnace.*

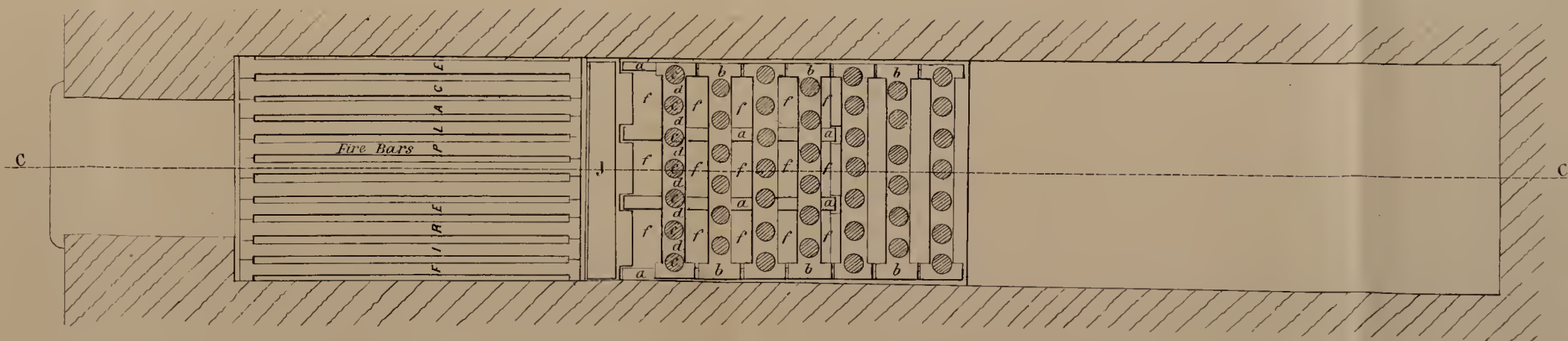


FIG. 7.

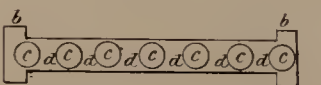


FIG. 6.

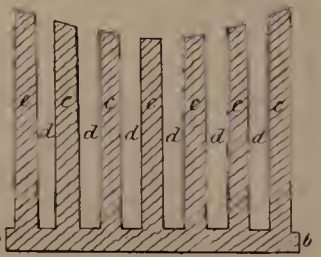


FIG. 5.

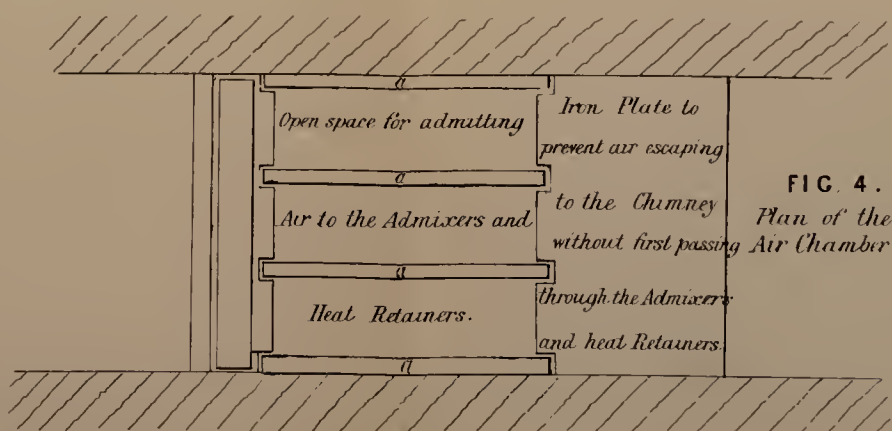
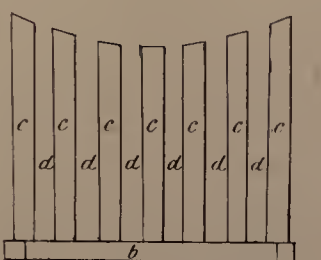


FIG. 4.  
*Plan of the Air Chamber.*





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upward currents, when the cooler liquid outside the cones rushes downwards to supply the place of that which is ascending, and thus ensures a rapid and continual circulation, and a quicker diffusion of heat.

Having now described the nature of my Invention, and the manner  
5 in which it is to be carried out in practice, I wish it to be understood that I do not confine myself to the precise form or proportion of the several parts herein detailed, as these are points which experience alone can satisfactorily determine; but that I claim, first, the intercepting the gases in their transit from the fireplace to the chimney, and  
10 dividing them into a number of small streams or bodies, and bringing these in contact with a current or currents of air, in such manner as to produce an intimate mechanical mixture of air and gases, in order to facilitate their chemical union; secondly, the application of admixers and heat-retainers, whether employed in conjunction with my apparatus  
15 for preventing smoke, or in furnaces of any other construction; and, thirdly, the application of hollow cones, open at both ends, for facilitating evaporation, and preventing the bottoms of vessels used in heating liquids from being burnt.

In witness whereof, I, the said Samuel Bayliss, have hereto set  
20 my hand and seal, the Fifteenth day of October, One thousand eight hundred and fifty-three.

SAM. BAYLISS. (L.S.)

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